Determine

(a) The average elapsed time from the time the secretary receives a job, until it is completed.

(b) Average number of jobs in a system.

(c) The probability that the time in the system is greater than half an hour.

(d) Probability of more than 5 jobs in the system.

Shanmuga Industries Arts & Science College T.V.Malai

APRIL/MAY 2023

GECA24A/DECA24A — OPERATION RESEARCH

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Write the general form of an L.P.P.

2. What are the characteristics of LPP?

3. Define Transportation model.

4. What is meant by degeneracy?

5. Write a short note on Integer programming model.

6. Mention the properties of Gomory's Algorithm.

7. Define –Critical Path.

8. Write a brief note on Optimistic time and pessimistic time.

9. What are the characteristics of Queuing model?

10. Define - Poisson Queue.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) List out the steps in formulation of L.P.P.

Or

(b) JOB and CO manufactures two products on two machines. A unit of product 1 requires 2 hrs on machine 1 and 1 hr on machine 2. For product 2, one unit requires 1 hr on machine 1 and 3 hrs on machine 2. The revenues per unit of products 1 and 2 are \$30 and \$20, respectively. The total daily processing time available for each machine is 8 hrs.

(i) If JOB and CO can increase the capacity of both machines, which machine should receive priority?

(ii) If the capacity of machine I is increased from 8 to 13 hrs, how will this increase impact the optimum revenue?

(iii) How can we determine the new optimum values of the variables associated with a change in a resource?

C	A, B	7	8	9
D	A, B	9	12	17
E	B	20	24	26
F	D, E	14	18	20
G	C, F	2	3	7
H	D, E	3	6	15
I	G, H	5	11	17

(a) Draw the network and identify the critical path.

(b) Find total and free float for all activities.

20. A department secretary receives an average of 8 jobs per hour. Many are short jobs, while other is quiet long. Assume however, that the time of to perform a job has an ED mean of 6 minutes.

17. Solve the following minimal assignment problem by Hungarian Method

	1	2	3	4
A	1	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

18. Explain the procedure of Branch and Bound Algorithm.

19. A PERT network consists of the activities whose details are given below:

Activity	Immediate Predecessor	Days		
		Optimistic time	Most likely	Pessimistic Time
A	--	7	10	12
B	--	16	18	20

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12. (a) Obtain an initial basic feasible solution to the following transportation problem using the north west corner rule:

	D	E	F	G	Available
A	11	13	17	11	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirment	200	225	275	250	

Or

(b) Solve the following assignment problem.

$$\begin{array}{c|cccc} & W & X & Y & Z \\ \hline A & 11 & 17 & 8 & 16 \\ B & 9 & 7 & 12 & 6 \\ C & 13 & 16 & 15 & 12 \\ D & 14 & 10 & 12 & 11 \end{array}$$

13. (a) Solve the following using Gomory's mixed integer problem

Max $Z = 4x_1 + 6x_2 + 2x_3$

Subjected to the constraints

$4x_1 - 4x_2 \leq 5,$

$-x_1 + 6x_2 \leq 5,$

$-x_1 + x_2 + x_3 \leq 5$

and $x_1, x_2, x_3 \geq 0$; 2 and x_1, x_3 are integers.

Or

(b) Solve the following integer programming problem using Gomory's method,

Max $Z = x_1 + x_2$,

Subjected to the conditions

$3x_1 + 2x_2 \leq 5$,

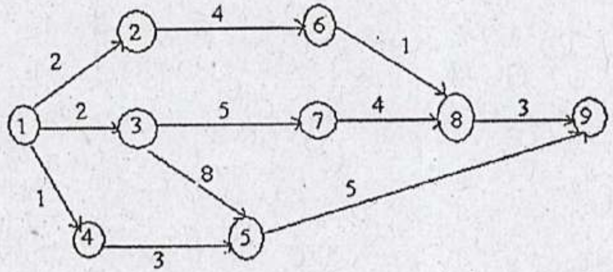
$x_2 \leq 2$,

and $x_1, x_2, \geq 0$ and integer.

14. (a) Distinguish between CPM and PERT networks.

Or

(b) Find the critical path and calculate the slack time for the following network.



15. (a) A supermarket has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find

(i) The probability that an arriving customer has to wait for service,

(ii) The average number of customers in the system, and

(iii) The average time spent by a customer in the super market.

Or

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(b) In a railway marshalling yard, goods train arrives at the rate of 30 trains per day. Assume that the inter arrival time follows an exponential distribution and the service time is also to be assumed as exponential with a mean of 36 minutes, Calculate

(i) The probability that the yard is empty

(ii) The average length assuming that the line capacity of the yard is 9 trains.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Use simplex method to solve the LPP.

Max $Z = 3x_1 + 2x_2$

Subject to :

$4x_1 + 3x_2 \leq 12$

$4x_1 + x_2 \leq 8$

$4x_1 - x_2 \leq 8$

$x_1, x_2 \geq 0$